CLINICAL STUDY OF PATIENTS WITH ABDOMINAL WOUND DEHISCENCE AT GOVERNMENT RAJAJI HOSPITAL, MADURAI MEDICAL COLLEGE, MADURAI

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CERTIFICATE

This is to certify that this dissertation entitled **"CLINICAL STUDY OF PATIENTS WITH ABDOMINAL WOUND DEHISCENCE"** at Madurai Medical College, Madurai is a bonafide research work done by **Dr.M.J. CHANDRABOSE AMBEDKAR** in partial fulfillment of the requirement for the degree of **M.S (General Surgery)**.

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I, hereby declare that this dissertation / thesis entitled **"CLINICAL STUDY OF PATIENTS WITH ABDOMINAL WOUND DEHISCENCE"** at Madurai Medical College, Madurai is a bonafide and genuine research work carried out by me under the guidance of Prof. M. Gobinath M.S., H.O.D., Department of General Surgery, Madurai Medical College.

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Date :

Place :

CONTENTS

ABSTRACT

AIMS AND OBJECTIVES:

To identify various predisposing factors in patients who burst their abdomen following mid line laparotomy.

MATERIALS AND METHODS:

Data were collected from patients, aged more than 18 years who had burst. abdomen following enniass closure of midline laparotomy in general surgery wards.

RESULTS AND CONCLUSION

Total of 18 patients (14 males and 4 females) had abdominal wound dchiscence. There mean age was 34.4yrs. 7(39.5%) were anemic, 5(27.5) had hypoprotenemia, 5(22.0%) had hyperbilirubinemia, 3(16.5%) had chest infection all had intraperitoneal infection, one was diabetic. All were emergency procedures. There was one (5.5%) mortality. Mean length of hospital stay was 25.2 days.

KEY WORDS: Abdominal wound dehiscence, infection, malnourishment

INTRODUCTION

Wound dehiscence carries with it a substantial morbidity. In addition there is an increase in the cost of care both in terms of increased hospital stay, nursing and manpower cost in managing the burst and its complications. Many patients in India have a poor nutritional status and the presentation of patient with peritonitis is often delayed in the emergency. This makes the problem of wound dehiscence more coninion and graver in our setting as compared to the West.

In I -2% of cases, mostly between the sixth and eighth day after operation an abdominal wound bursts open and viscera are extruded. The disruption of the wound tends to occur a few days before hand when thc sutures apposing the deep layers sheath tear through or even become untied. An incisional hernia starts as a symptomless partial disruption of the deep layers during the immediate or early postoperative period, even this passing unnoticed if the skin wound remains intact after the skin sutures have been removed.

AIMS AND OBJECTIVES

To identify various predisposing factors in patients who burst their abdomen following midline laparatomy.

REVIEW OF LITERATURE

ANATOMY OF ANTERIOR ABDOMINAL WALL

Layers of the Abdominal Wall

The abdominal wall consists of seven layers of tissue, of which the fourth or middle layer, the muscle—bone layer, is the most important. These layers will he considered in the order in which they are encountered while progressing inward.

I. Skin

The skin is the outermost layer. The course of the connective bundles of the coriurn fonns lines of tension **(Langer's** lines of cleavage) in the skin. Over the anterior abdomen, these lines of cleavage run in a more or less transverse direction. Skin incisions made parallel to these lines of cleavage result in much liner scars than do those that cut across the lines of cleavage.

2. Subcutaneous tissue

This layer consists of fat, which is variable in amount, contained within fibrous compartments. The more superficial portion of the subcutaneous fat contains much less fibrous tissue than does the deeper portion. This is called Camper's fascia. The deeper portion of the subcutaneous tissue of the abdominal wall contains more fibrous elements and forms a membranous fascial layer and this is called Scarpa's fascia.

3. Deep Fascia

The deep fascia of the abdominal wall is an ill-defined, thin and unimportant layer consisting of loosely formed fibrous tissue.

4. Muscle-Bone Layer

This is the most important of the seven layers, consisting of nine muscles with their fasciae and aponeuroses on each side of the midline and the five lumbar vertebrae situated posteriorly. On either side of the anterior midline (linea alba) of the abdomen are situated the right and left rectus abdominis and pyramidalis muscles These muscles form the anterior group. Their fibers run in a vertical direction and are enveloped between the anterior and posterior rectus sheaths, formed by a splitting of the aponeuroses of the internal oblique muscles.

Lateral to the anterior group are the external oblique, internal oblique and transversus abdoniinis muscles with their fasciae and aponeuroses. These three muscles form the flat or oblique group, extending laterally and posteriorly from the lateral border of the rectus abdominis, posteriorly to the lateral border of quadratus lumborum muscle. The direction of their fibers is closer to transverse than to vertical.

ANTERIOR AND LATERAL (OBLIQUE) ABDOMINAL MUSCLES AND RELATED STRUCTURES

The rectus abdominis muscle (one on each side) is attached below to the os pubis and ligaments of the symphysis pubis, whereas superiorly it is attached to the xiphoid cartilage and the anterior surfaces of the fifth, sixth and seventh ribs. The rectus muscle is crossed by three transverse tendinous intersections. The lack of attachment of the tendinous intersections to the posterior rectus sheath permits the muscle belly to he retracted so that a paramedian incision can be made.

The internal oblique muscle arises from the lumbodorsal fascia, the anterior halfof the iliac crest and the lateral half of the inguinal (Poupart's) ligament.

The aponeurotic IThers of internal oblique split into two lamellae. The anterior laniella passes in front of the rectus muscle and fuses with the aponeurosis of the external oblique muscle to form the anterior sheath of the rectus niLiscie. The posterior lamella passes behind the rectus muscle to fuse with the aponeurotie fibers of the transversus abdominis and form the posterior sheath of the rectus, which also inserts into the linea alba.

The posterior rectus sheath ends inferiorly at the arcuate line, (semicircular line of Douglas) which is present at variable levels above the symphysis in different individuals.

The transversus abdominis muscle arises from the lateral third of the inguinal (Poupart's) ligament, the anterior three fourths of the cresi of the ilium, the lunibodorsal fasciaand lower six ribs.

The nerve supply of the rectus abdominis, external oblique, internal oblique, and transversus abdominis muscles conies by way of the lower six or seven intercosta' and f lumbar nerves (by The ihohypogastric nerve, which is formed by the twelfth thoracic and first lumbar nerves, and by the ilioinguinal nerve, which arises from the first lumbar). In their course across the abdominal wall, the nerves can be retracted upward or downward for variable distances without being injured.

The anterolateral abdominal wall receives its arterial blood supply from the last six intercostal and the four lumbar arteries together with the superior and inferior epigastric and the deep circumflex iliac arteries. The superior and inferior epigastric arteries anastomose only sparsely with their fellows of the opposite side; therefore, the linea alba is a relatively avascular area and has a poor blood supply.

5. Transversalis Fascia

The t layer of the abdominal wall is the transversatis fascia. The portion of transversalis fascia beneath the rectus muscle is so intimately attached to the overlying posterior rectus sheath and underlying peritoncum that the three layers arc sutured together as one layer in closing the peritoneal layer of the incision.

The transversalis fascia is attached below to the inner lip of the iliac crest, the outer half of the inguinal (Poupart's) ligament, the lacunar ligament (of Gimbernat), and the pubic crest. This fascia is continued downward behind the mesial half of the inguinal ligament and over the femoral vessels to pass into the thigh, forming the femoral sheath.

6. Extraperitoneal Fat Layer

This laycr consists of loose areolar fibrous tissue containing variable amounts of fat and lies between the overlying transversalis fascia and underlying parietal peritoneum.

7. Peritoneurn

The parietal peritoncum is the smooth, serous layer that bounds the peritoneal cavity and is reflected onto the various viscera to form the visceral peritoneum as well as ligaments, mesenteries. Peritoneum strctehes easily and has little strength, so (hat it requires the support of its overlying muscles atid fascia to maintain the normal boundaries and shape of the abdominal cavity.

Linea Alba

The linea alba extends in the anterior midline of the abdomen from the xiphoid to thc symphysis. The linca alba consists of a band of dense, crisscrossed fibers of the aponeuroses of the broad abdominal muscles.

At the linea alba, the aponeurosis of the anterior sheath of the rectus muscle, Rise with the posterior rectus sheath and with opposite side. Above the umbilicus it widens out, but below that level it is narrow and sometimes difficult to recognize. In the broad supraumbilical portion of the linea alba, small openings are present through which the perforating vessels and nerves pass and through which an epigastric hernia may occur. Since the branches of the epigastric arteries anastomose very sparsely across the midline, the blood supply of the linea alba is less copious than in other areas.

Furthermore, an incision made in the midline is through a relatively avascular layer with minimal attendant bleeding and does not destroy the innervation of any part of any muscle. It is believed, however, to be more prone to postoperative herniation than are incisions in other locations, because of its relatively meager blood supply.

Umbilicus

The umbilicus is the fibroaponeurotic scar formed within the central portion of the linea alba. This represents the embryonic defect in the abdominal wall through whicn we vitellointestinal duct omphalomesenteric vessels , and

urachus pass, but under normal conditions these structures atrophy into fibrous cords.

Acute wounds and acute wound healing

An acute wound is defined as the traumatic loss of normal structure and function to recently uninjured tissue after a noxious insult. Acute wound healing is the highly regulated process of cellular, humoral and molecular events activated at the time of acute injury and resulting in a time-dependent but predictable and orderly pattern of tissue repair. The integrated summation of each pathway along the continuum of this host response to injury results in acute wound healing.

NORMAL WOUND HEALING

Wound healing Follows a complex and orderly pattern of events in which an initial inflammatory reaction (inflammatory phase) is characterized by an increase in vascular permeability followed by fibrin deposition and an influx of red cells, polymorpholeukocytes, monocytes, and platelets. Local cellular disruption perpetuates itself, with the release of protcolytic enzymes and vasoactive substances into the wound space. An activated complement system continues the inflammatory reaction and helps to attract macrophages which clear the debris of inflammation. Fihrohlasts appear about the fourth postinjury d with fibroplasia **(proliferative phase).** During this metabolically active time which lasts from 2 to 4 weeks neovascularization allows the delivery of

nutrients while fibroblast proliferation allows for the production of mucopolysaccharides and collagen. The final phase of wound healing **(maturation phase)** continues for months, as collagen fibers are aligned and cross-linked, allowing for a progressive increase in wound strength.

This sequence is essentially the same in all species and organ systems studied, although the time reference may change drastically. For example, a gastric anastomosis may take a few weeks to heal, whereas the fascial incision used to provide exposure may take up to years to achieve maturity.

TYPES OF INCISIONS

Abdominal incisions can be divided roughly into three general types: (1) vertical incisions (2) transverse incisions and (3) special incisions.

Abdominal incisions have a marked effect on pulmonary physiology. Pulmonary complications have been reported to be related more to the location than to the direction of the incision. Upper abdominal incisions are more significant in their effect upon respiration. Breathing patterns are changed; the respiratory rate increases and tidal volume and vital capacity are reduced. Patients tend to become hypoxemie. Forced expiratory volume at I second (FEV_1) is reduced.

In 1940s, it was noted that pulmonary complications occurred four times more frequently in the patient with a vertical rather than a transverse abdominal incision. Rees and CoIler[3] and Coller and Maclean expressed a strong

preference for transverse incisions over vertical ones for ah4Qrninal operations and pointed out these advantages:

1. The skin incision parallels Langers lines and gives a better cosmetic result.
2. Transverse incisions are closed iii a direction that places only one thirtieth as much tension on the suture line as is exerted on the suture line of a vertical incision.
3. When transverse incisions are, tensed the edges of the transverse wound tend to be approximated while the edges of a vertical wound are strongly separated.
4. Transverse incisions facilitate closure of the peritoneum and posterior rectus sheath, a factor in minimizing postoperative adhesions.
5. Transverse incisions run almost parallel to the direction of the neural and vascular supply and therefore destroy fewer nerves and blood vessels than do vertical incisions.
6. The blood supply to the region of a transverse incision is better than that to a vertical midline incision, and therefore healing of a transverse incision should be more rapid.

The purported predisposition and reasons for use of the transverse incision can he balanced against the advantages of vertical incisions:

1. Vertical midline or paramedian incisions arc more quickly made and more quickly closed. They pass through fewer tissue layers and require less suturing and time for closure.

2. Vertical midline or paramedian incisions destroy few if any nerves or blood vessels supplying the tissues.

3. Vertical midline or paramedian incisions are made through a relatively avascular field and give less troublesome bleeding than do transverse incisions.

4. In some areas, vertical midline or paramedian incisions provide better exposure or are more easily extended than transverse incisions. This is particularly true for operations on the cardiac end of the stomach or the rectosigmoid.

There is a place for both vertical and transverse incisions. When vertical incisions are used, they should be in the midline or paramedian and middle or lateral transrectus in exceptional circumstances. Special incisions also have a place in specific operations.

An incision should be selected with the following qualifications in mind:

1. It must give ready and direct access to the source of trouble and provide adequate exposure for the operation contemplated.
2. It should be extensible in the direction that probably would be required by any increase in the magnitude of the operation.

3. It should injure the fewest possible number of motor nerves, preferably not more than one.
4. It should be capable of being securely repaired so as to leave the abdominal wall at least as strong after the operation as before.
5. It should provide an acceptable cosmetic result when possible.

It is important that an abdominal incision be made long enough to provide an adequate visualization of the operative field and uncrowded conditions for the necessary manipulations.

Upper Midline incisions

This is the incision preferred by many surgeons for exploration of and most operations on the stomach. It provides excellent exposure in partial gastrectomy and can easily be extended upward or into the chest for total gastrectomy or operations on the lower esophagus or diaphragm. It can be extended downward around the navel for as far as necessary and, when required, can be extended laterally as a T or an L incision. An upper midline incision destroys no nerves and can be quickly made and easily closed. It is thought to be more vulnerable to postoperative herniation because of its relatively meager blood supply.

Technique:

An incision is made through the skin and subcutaneous tissue from the tip of the xiphoid downward in the midline to a point about 3 cm proximal to

the umbilicus. If a longer incision is desired, it is extended downward to curve around either the right or left side of the umbilicus' to continue in the lower midline.

The shiny white linea alba and anterior rectus sheath are cleared of fat laterally for about 2 cm on each side. The linea alba and transversalis fascia are divided exactly in the midline, exposing the extraperitoneal fat. After the peritoneal cavity has been opened, a finger is slipped beneath it, and the peritoneum is divided over the finger as it is advanced upward and downward, protecting underlying viscera from injury. If the ligamentum teres interferes with exposure , it should be divided between clamps and the cut ends ligated. One should select the method of closure that is best for the patient and is well performed by the surgeon.

WOUND CLOSURE IN LAYERS

In the patient whose condition is good and in whom rapid closure is not imperative, the wound can be approximated in layers in the following manner:

1. The cut edges of the peritoneum, transversalis fascia and posterior rectus sheath are approximated with a row of continuous over-and-over suture of 2-0 plain catgut, 2-0 chromic or synthetic absorbable. Others prefer interrupted sutures of the same materials or of silk. If the peritoneum is friable, few muscle fibers and the deep and medial portion of the rectus muscle should be included in each bit to provide firmer anchorage.

2. The cut edges of the linea alba are approximated with interrupted sutures. This is the most important and strength—giving portion of the closure and must he performed with care. Nonabsorbable suture material is best for this purpose. One could use 0-nylon, No. 1 polypropylene or 3-0 (B&S 30) stainless-steel wire suture in patients in whom the intestinal tract has been opened or drainage is instituted. Some surgeons prefer to use absorbable suture material for this layer. No. I chromic catgut or synthetic absorbable sutures have been used successfully. Many other sutures are also acceptable.

When there is little or no tension, a row of simple, interrupted, over-and-over sutures placed through the linea alba at least 1 cm lateral to the cut edge on each side and including a few underlying fibers of the rectus muscle in each side, is used.

When the cut edges of the linea alba can be approximated only with tension, one can close with interrupted far-near sutures. These penetrate the rectus sheath about 3 cms lateral to the cut edge, pass beneath it through the anterior fibers of the rectus muscle to cross the wound and emerge through the anterior rectus sheath 0.5cm from its cut edge on the other side, cross over the wound to penetrate the original side of the anterior sheath from superficial to deep at a point 0.5 cm lateral to its cut edge, recross the wound, and pass

through the superficial rectus fibers beneath the rectus sheath of the other side to emerge about 3 cm lateral to the edges. When these sutures are pulled taut and tied, any tension is distributed to four points instead of only two and a stronger closure results. Although more time is consumed in closing the incision

When closing either the peritoneal or linea alba layer, the suturing should begin at the lower end of the incision and progress upward toward the xiphoid. Sutures should be placed about 1 cm apart and, at the conclusion of the closure, there should be no space between them wide enough to admit the tip of a little finger.

3. Alter the linea alba has been firmly closed, the subcutaneous fat and fascia are approximated with 4-0 plain catgut, 3-0 or 4-0 synthetic absorbable sutures, or 4-0 silk, placed as simple over-and-over interrupted sutures. Silk should never be used in possibly contaminated wounds.
4. The skin is closed with 3-0 or 4-0 nylon or 4-0 silk continuous or interrupted sutures. If the wound is suspected of possible contamination, one should use interrupted sutures.

Lower Midline Incision

It is frequently used for operations on the rectosigmoid and other viscera in the lower abdomen or pelvis. When this incision is contemplated, one should

make certain that the urinary bladder has been emptied just before the operation.

Technique

Skin and subcutaneous are opened as described in upper midline incision. The linea alba is narrow below the umbilicus and may be difficult to identify. When its exact location is in doubt, the anterior rectus sheath should be incised carefully just above the symphysis pubis, where the direction of the fibers of the pyramidalis muscle on either side will lead upward to the midline. Once its location is identified, the linea alba is incised at the upper end of the incision, and this incision is carried down to the symphysis pubis.

The right and left rectus sheaths, with their contained rectus muscles, are retracted laterally, exposing the underlying transversalis fascia, urachus, and peritoneum.

The peritoneal layer is carefully opened about 4 cm below the umbilicus and, before it is divided further, two fingers are inserted into the peritoneal cavity and passed downward to palpate the upper limits of the urinary bladder. With the fingers pushing the peritoneum anteriorly, the transversalis fascia is divided vertically downward by blunt dissection with the handle of the knife to the symphysis pubis. This maneuver will strip any upward extension of the bladder downward out of the way. The thin peritoneum can now be incised vertically with relative safety for the entire length of the abdominal incision.

The peritoneum and anterior rectus sheath is closed with a technique used to close the upper midline incision.

Definition:

Wound dehiscence — It is defined as separation of fascial layers early in the post operative course. It is also called burst abdomen, if dehiscence of laparotomy wound occurs. Three types of lesions can be distinguished.

- Free, with complete ruptures of all layers and viscera protruding out of the abdominal cavity.
- Fixed with complete rupture of all layers but fixed viscera that remain in the abdominal cavity.
- Covered with rupture of the deep layers while the cutaneous sutures remain intact.

The covered burst abdomen is an indication for Sonography.

Clinical presentation

A serosanguinous (pink) discharge from the wound is a forerunner of disruption in 50% of eases. It is the most pathognomonic sign of impending wound disruption and it signifies that intraperitoneal contents are lying extraperitoneally. Patients often volunteer the information that they felt something given way. If skin sutures have been removed omentum or coils of

intestine may be forced through the wound and will be found lying on the skin. Pain and shock are often absent.

Unexplained tachycardia may be the one of the mode of presentation. It is important to note that there may be signs of intestinal obstruction. Evisceration is a surgical emergency and if encountered the eviscerated intestines should be covered with sterile saline moistened towel and preparations made to return to the operating room emergently.

Etiology of wound dehiscence[8]

Following are the factors responsible for wound dehiscence

- Technical error
- Intraabdominal infections
- Malnutrition
- Advanced age
- Chronic corticosteroids use
- Wound complications (Hematoma — infection, tension)
- Underlying disease (diabetes renal failure cancer Anemia, Immune deficiency, Chemotherapy, Irradiations, Hepatic dysfunction)
- Increased intra abdominal pressure (coughing, abdominal distension).
- Hypoxia.

Technical error

Prevention of wound dehiscence is largely a function of careful attention to technical detail during lascial closure. The basic principles of suture selection are:

1. When wound has reached maximum strength sutures arc no longer needed.

   Therefore:

a. Tissues that ordinarily heal slowly, such as skin; fascia and tendons should usually be closed with non-absorbable.

b. Tissues that heal rapidly such as stomach colon and bladder maybe closed with absorbable sutures.

2. Foreign bodies in potentially contaminated tissues may convert contamination to infection. Therefore

   a. Avoid multifilament sutures, which may convert a contaminated wound into a infected one.

   b. Use monofilament or absorbable sutures in tissue with potential for contamination.

3. Where cosmetic results are important, close and prolonged apposition of wounds and avoidance of irritants will produce the best result. Therefore

a. Use the smallest inert monofilament suture materials such as nylon or polypropylene.
b. Avoid skin sutures and whenever possible close sub-cuticular.
c. Under certain circumstances to secure close opposition of the skin edges, skin closure tape maybe used.

4. Foreign bodies in the presence of fluids containing high concentration of crystalloids may act as nidus for precipitation and stone formation. Therefore

   a. In the urinary tract and biliary tract, use rapidly absorbed sutures.

5. Regarding the suture site:

   a. Use the Finest size commensurate with the natural strength
   b. of the tissue
   c. If the postoperative course of the patient may produce sudden strains on the suture line reinforce it with retention sutures. Remove them as soon as the patient’s condition is stable.

ANATOMIC CONSIDERATIONS

Peritoneum

The peritoneal layer should be exactly approximated when possible to minimize the occurrence of postoperative adhesions to the line of the incision.

Peritoneum along with transversalis fascia, and (when present) the posterior sheath can he closed as one layer continuous absorbable lock-stitch.

If due to previous operations, peritoneal layer could not he isolated separate, the wound can be closed by nonabsorbable through-and-through or far- near pulley sutures placed through the fascia, muscle and pertoneum.

Muscle Layers

Muscles that have been separated in the direction of their fibers can be approximated by interrupted sutures. When the fibers have been cut across, they cannot be approximated by suture unless the muscle contains or is invested by sufficient fibrous tissue to hold the suture. Muscle suturing is performed primarily to obliterate dead space. It provides little strength. In contaminated wounds, muscle sutures should he of catgut or synthetic absorbable suture. In clean wounds, catgut, silk, or synthetic absorbable suture may be used.

Aponeuroses

The aponeurotic layer provides the strength to the successful wound closure. It should be approximated with great care under little or no tension and

without ischemia. Nonabsorbable sutures may be employed for closure. If the wound has been contaminated, one should use interrupted sutures of 3-0 (B&S 28) stainless-steel wire or 0 to No. 2 polypropylene or nylon. For clean wounds, interrupted sutures of 3-0 (B&S 28) stainless-steel wire, No. I silk, 0 to No. 2 polypropylene, cotton, nylon, or synthetic absorbable suture are used.

There area number of different ways of placing these sutures. A simple end-over suture in the average wound with good tissues easily approximates edges. If these conditions are absent, then a far-near pulley-type of suture approximates the edge more strongly because any tension is distributed to the four points of tissue penetrated rather than to only two.

Subcutaneous tissue

It is sutured with 4-0 silk (clean wounds) or catgut or synthetic absorbable suture that bites Scarpa's lascia on each side, obliterating dead space and taking some of the tension off the skin suture line.

Skin

Most surgeons use stainless-steel staples to close the skin.

Skin edges can be approximated with a nonabsorbable suture material. Usually nylon. One good method is a simple over—and—over suture (continuous in clean wounds and interrupted in contaminated wounds). Some prefer interrupted or continuous end-on mattress sutures, which are thought to

provide a better cosmetic result but take longer to place. Others prefer a continuous over-and-over lock- stitch.

Tissue adhesives for skin closure have been used without adverse effects. It is suitable for the closure of simple lacerations in the pediatric population, wound closure when Follow-up visits are difficult and when incisions are under a cast At present, tissue adhesives are not indicated for skin closure over mobile areas such as joints, areas that experience friction such as hands or feet, and incisions on the face or eyelids that demand precise alignment.

TYPES OF WOUND CLOSURES

Single Row of Interrupted Sutures

Successful closure of a wound can be obtained by buried monofilament stainless—steel retention sutures. The incidence of wound disruption using this technique has been reported to be as low as 0.4%. After carefully obtaining hemostasis, the abdomen is closed using 2-0 (B&S 28) stainless-steel monofilament wire.

The single suture is passed through the fascial-muscular layers and peritoneum. The margins of the incision are carefully apposed. Care is taken not to tic too tightly. Wire tails al-c carefully buried. One could substitute 0 to 2 polypropylene or similar material for wire and expect similar results. Subcutaneous tissue is approximated as previously described.

Single Row of Sutures Through All Layers

If the patient's condition has deteriorated so that a rapid closure of the wound is desirable, when the wound is contaminated, when chest complications associated with heavy coughing are present, or when a disrupted wound is being closed, a satisfactory method of closure is with a simple row of through-and through wire sutures, which pass through all the layers of the abdominal wound. Heavy wire, as thick as No. 2 (B&S 23) stainless steel monofilament, is used. Heavy monofilament nylon or polypropylene, No. 2 or heavier, could be substituted. The sutures are placed about 2 cm apart.

The method of wound closure with wire, nylon, or polypropylene sutures passed through all layers is rapid and gives a strong closure. One or two sutures may cut entirely through the skin and require removal, but all the sutures should not he removed until after the fourteenth to eighteenth postoperative day. Incisional hernias are said to be uncommon after this type of wound closure.

Continuous Suture

Fascial closure by the technique of continuous suture is a timesaver. The theoretic advantage of this closure is the equal distribution of tension over the entire length of the closed fascial layer. In sonic reports, the risk of dehiscence is less than with interrupted closure. The amount of suture material in the wound and time required is much less than with interrupted closure. A disadvantage is that if the suture breaks, the entire wound can separate. A

monofilament No. 2 nylon or polypropylene may be used. The initial suture is placed, tying the knot intraperitoneally. The continuous suture is then “run, placing the needle so the suture enters tissue at least 2.5 cm from the margin of the incision and keeping the stitches about 1 to 1.5 cm apart.

Tom Jones Far-and-near Sutures

The fascial-muscular layers and parietal peritoneum are approximated by a single row of 2-0 (B&S 28) stainless-steel monofilament wire sutures or 0 or No. 1 polypropylene. A large atraurnatic needle is passed through one side of the incision, passing through the anterior rectus sheath, the rectus muscle, the posterior rectus sheath, and the parietal peritoneum, about 2.5 to 3 cm from the edge of the incision, entering the peritoneal cavity. The needle and suture arc then passed through the same layers on the opposite side of the wound in the reverse order. The needle is then reinserted and a suture is passed in the same plane and direction, but it is passed through close to the incised edge of the anterior rectus sheath. When closing a midline incision, one passes the suture through the cut edge along the linea alba. With method Goligher reported a dehiscence/incisional hernia incidence of 0.9%.

Retention Sutures

A retention suture is a reinforcing suture for abdominal wounds, utilizing exceptionally strong nonabsorbable suture material like braided silk, stainless steel, nylon, polypropylene, or silkworm gut, and including a large amount of

tissue in each stitch. It is intended to relieve pressure on the primary suture line and to prevent postoperative disruption. Nonabsorbable suture materials are used for retention sutures.

They are placed lateral to the wound so as to pass through the skin, subcutaneous tissues, anterior sheath, and rectus muscle on one side; then pass the suture deep to the rectus muscle (but superficial to the peritoneal layer) to cross the incision and penetrate outward through the rectus muscle, anterior sheath, subcutaneous tissue, and skin at a corresponding distance lateral to the other side of the wound. A disadvantage of this method is that one may inadvertently go too deep and damage the small bowel or sutures may be tied too tightly and the tissue may become edematous, compromising the blood supply and resulting in tissue death and slough. Rubber bridges are used to prevent tying the suture too tightly. Various forms of wound splints have been used with retention sutures to prevent pressure necrosis.

Most retention sutures are removed at 10 to 14 days postoperatively or when the patient has stabilized to the point at which these sutures are no longer needed. Retention sutures can become the portal for bacterial access into a clean wound. Therefore meticulous attention must be given to wound care. Retention sutures can be buried and left permanently. If the wound becomes infected, it can be opened with out the risk are dehiscence.

Malnutrition

Wounding leads to an increased metabolic rate, increased catecholamine levels, loss of total body water, and increased collagen and other cellular turnover. Malnutrition encompasses a host of factors from poor nutritional intake to overall metabolic equilibrium. Loss of protein from protein-calorie malnutrition leads to decreased wound tensile strength, decreased T-cell function, decreased phagocytic activity and decreased complement and antibody levels, ultimately diminishing the body's ability to defend the wound against infection.

Approximately 50% of all medical and surgical patients at an urban hospital in 1974 showed evidence of malnutrition.

Carbohydrates:

Carbohydrates, together with fats, are the primary sources of energy in the body and consequently in the wound healing process. The energy requirements for wound healing consist mainly of the energy required to carry out collagen synthesis in the wound.

Fatty acids:

Several unsaturated fatty acids must be supplied in the diet as deficiencies of these lipids cause impairment in wound healing in animals and humans. This impairment is due to the role phospholipids play as constituents of the cellular basement membrane and the participation of prostaglandins in

cellular metabolism and inflammation. Total parenteral nutrition (TPN) is the most common cause of essential fatty acid deficiency.

Branched-chain amino acids:

The branched-chain amino acids valine, leucine and isoleucine have been used to treat liver disease and have an additional role in retaining nitrogen in sepsis, trauma, and burns.' Branched-chain amino acids support protein synthesis serve as caloric substrates. Despite these useful properties, high supplements of branched-chain amino acids have not proved to be of any significant benefit in improving wound healing.

Glutamine:

Glutamine is the most abundant amino acid in the body. The process of gluconeogenesis involves the shuttling of alanine and glutamine to the liver for conversion to glucose, which is used peripherally as fuel to power certain aspects of wound healing. Glutamine also is an important precursor for the synthesis of nucleotides in cells, including fibroblasts and macrophages. Glutamine is as all energy source for lymphocytes and is essential for lymphocyte proliferation. Finally, glutamine has a crucial role in stimulating the inflammatory immune response occurring early in wound healing.

Although efficacy of supplemental glutamine administration has been shown in some clinical situations, it has not proved to have any noticeable effect on wound healing.

Arginine:

It is an essential amino acid. In humans, arginine supplementation in doses that are able to increase wound healing also increase plasma insulin like growth factor, the peripheral mediator of growth hormone. Arginine stimulates 1- Cell responses and reduces the inhibitory effect of injury and wounding on 1-Cell function. Arginine has been identified as the unique substrate for the generation of the highly reactive radical nitric oxide (NO). Several studies suggest that No plays a crucial role in wound healing.

Vitamins

The vitamins closely associated with wound healing are vitamin C and vitamin A Ascorbic acid is a co-substrate for the enzymes 4-hydroxylase and lysyl hydroxylase which are required for the conversion of proline and lysine to hydroxyproline and hydroxylysine.

Vitamin C deficiency, in addition to impairing wound healing, has been associated with an increased susceptibility to wound infection.

Ehrlich and Hunt described the benefits of supplemental vitamin A on wound healing in non deficient humans and animals in the 1960s and 1970s. The administration of vitamin A, topically or systemically, can correct the impaired wound healing of patients on long-term steroid therapy. Vitamin A also has been used to restore wound healing impaired by diabetes, tumor formation, cyclophosphamide or radiation.

Vitamin A increases the inflammatory response in wounds. The increased response is thought to occur by an enhanced lysosonial membrane labiality, increased macrophage influx and activation and stimulation of collagen synthesis.

Vitamin K is known as the antihemorrhage vitamin and is required for the carboxylation of glutamate in clotting factors I VII, IX, and X. Vitamin K contributes little to wound healing, but its absence or deficiency leads to decreased coagulation, which consequently affects the initial phases of healing.

Micronutrients

The term, *micronutrients* refer to the extremely small quantities of these compounds found in the body. They serve as cofactors or part of an enzyme that is essential to healing and homoeostasis. It is often easier to prevent these deficiencies than to diagnose them clinically.

Magnesium is a macromineral that is essential for wound repair. The primary role of is to provide structural stability to ATP, which powers many of the processes used in collagen synthesis, making it a factor essential to wound repair[25].

Of the numerous trace elements present in the body, copper, zinc, and iron have the closest relationship to wound healing. Lysyl oxidase is a key copper enzyme used in the development of connective tissue, where it catalyzes the cross- linking of collagen and strengthens the collagen framework.

Zinc is a cofactor for RNA and DNA polymerase and consequently is involved in DNA synthesis, protein synthesis, and cellular proliferation. In zinc deficiency, fibroblast proliferation and collagen synthesis are decreased. Immune function is impaired in zinc deficiency. Zinc levels can be depleted in settings of severe stress and in patients receiving long-term steroids.

Iron is required for the hydroxylation of proline and lysine, and as a result, severe iron deficiency can result in impaired collagen production. As a part of the oxygen transport system, iron can affect wound healing, but this occurs only in settings of severe iron-deficiency anemia.

Evaluation of overall nutritional state

Clinicians must be aware of nutritional disturbances in wounded patients before these nutritional deficits can be corrected. The severity of the deficit must he assessed, and the caloric requirements for healing to ensue should be estimated. Kinney outlined the metabolic adjustments experienced after injury as follows:

1. Uncomplicated intra-abdominal surgery increases metabolic rate approximately 10%.
2. Uncomplicated injuries, such as femural fracture, increase metabolism about 20%.
3. Peritonitis increases metabolism 20% to 40%.
4. Third-degree burns increase metabolism 50% to 100%.
5. Fever alone increases metabolism 10% for each 1°C.

Historically the sine qua non of linear nutritional status over time has been serial weight measurements. This commonly used marker for malnutrition can be misleading. Other markers predictive of nutritional state include serum albumin and transferrin levels, total lymphocyte count, urinary nitrogen and respiratory minute volume.

Advanced age:

With aging there is a decline in physiologic function in all organ system, although the magnitude of the decline is variable among organs and among individuals. In the resting state, this decline usually has minimal functional consequences, although physiologic reserve may be utilized just to maintain homeostasis. However, when physiological reserves are required to meet the additional challenges of surgery or acute illness over all performance may deteriorate. This progressive age related decline in organ system homeostatic reserve known as homeostensosis[29].

Although physiological decline may present, it is seldom sufficient to cause negative outcome in the elective uncomplicated case. The presence of co-existing disease, however, strongly influences outcome In any setting with the age there is a clear rise in disease of organ system other than that for which the older patients seeks surgical care. Chronic obstructive pulmonary diseases, BPH which are common in older patient are the factor which can increase intra abdominal and predispose to burst abdomen.

There are numerous studies that document the impact of co morbidity on outcome. Adverse events increased consistently with increasing co-morbidity.

In a study of hospitalized patient older than 7Oyrs, 85%- 46% of moderate to severe nutritional deficits identified on formal admission assessments; malnutrition being one of the predisposing factors for wound dehiscence.

Underlying disease:

Diabetes; Renal failure; Malignancy; Immune deficiency, hepatic dysfunction for the most commonly seen underlying disease in patients admitted for surgical condition.

Diabetes:

While the general notion that diabetics do not heal well is often correct, adequate treatment of the diabetic patient with insulin usually resolves potential problems.

An incidence of 10.4 to 10.7 percent of wound infection in diabetic patients has been compared with incidence of 4.8 to 7.4 percent in non diabetic patients.

When Polk et al controlled for age, the incidence of wound infection in diabetic surgical patients was same as in nondiabetics.

Goodson and Hunt have shown that obesity, insulin resistance, hyperglycemia, and depressed leukocyte function interfere with collagen synthesis and thus impair wound healing.

Defects in wound healing in diabetes mellitus that are correctable by the administration of insulin and / or the reduction of hyperglycemia include (1) granulocyte phagocytosis, (2) granulocyte chemotaxis, (3) granulocyte killing of bacteria, (4) granulocyte adherence, (5) synthesis of protocollagen, (6) synthesis of collagen, (7) capillary ingrowth, and (8) fibroblast proliferation.

In 1964, Bybee and Rogers reported diminished phagocytic activity in granulocytes from diabetic patients. In 1972, Mowat and Baum2 demonstrated poor chemotaxis of granulocytes from diabetics. In a series of studies from Bagdade's laboratory, the granulocytes from diabetic persons demonstrated poor killing of both pneumococci and staphylococci when ambient glucose was high. Robson and 1-leggers showed that gram-positive bacteria thrived in hyperglycemic serum and those gram-negative bacteria grew less well in hyperglycemic serum. This may partially explain the clinical observation that diabetic patients are prone to staphylococcal infection. The data of another recent study suggests that it is insulin availability, rather than hyperglycemia per se, that is particularly important to good capillary in growth into the wound.

Though it is of great academic interest whether the defects in wound healing are ascribed to insulin lack, the presence of extra cellular

hyperglycemia, or a deficit of intracellular glucose, the practical clinical treatment remains relatively simple. Insulin treatment of hyperglycemic diabetic patients will supply the needed insulin, lower the extra cellular glucose, and increase intracellular glucose levels. Blood glucose of 250 mg per dl during operation and normalization of blood glucose preoperatively and postoperatively is recommended.

The key to, good glucose management in these patients is frequent measurement of their blood glucose level and readjustment of their insulin dosage as necessary.

ANTINEOPLASTIC THERAPY

Inflammatory phase :There will be attenuation of the vascular response to injury with a delay in permeability and a decrease in fibrin deposition and cellular infiltration, interference on the lysosomal level, with a decrease in lysosomal disruption (with a diminished release of proteases) associated with a decrease in wound healing.

Proliferative phase: This phase of wound healing is a very metabolically active, and can be blunted by any decrease in local nutrient delivery, either because of a decreased neovascularity or systemic depletion (due to antineoplastic therapy). The majority of antineoplastic agents exerts their cytotoxic effect by interfering with DNA or RNA production, protein synthesis, or cell division, and in this way directly affects fibroblast production or

collagen synthesis. The myofibroblast, a more specialized type of fibroblast holds the key to wound contraction, and interference by antineoplastic agents can lead to a delay in wound healing.

The final phase of wound healing, the maturation phase, involves the modification of collagen fibre alignment and cross-linking. Those antineoplastic agents that affect collagen metabolism would be detrimental at this point.

HORMONAL AGENTS

Corticosteroids:

Many patients are put on corticosteroids for extended period. Many of the actions of corticosteroids have implication in the wound healing which are described below.

Anti-inflammatory and immunosuppressive effects:

Glucocorticoids dramatically reduce the manifestations of inflammation, due to their profound effects on the concentration, distribution and function of peripheral leucocytes and to their suppressive effects on the inflammatory cytokines and chemokines and on other lipid and glycolipid mediators of inflammation. Glucocorticoids inhibit the function of tissue macrophages and other antigen presenting cells by limiting their ability to phagocytose and kill microorganism and to produce tumor necrosis factor, interleukin, metalloproteinases and plasminogen activator. Glucocorticoids influence the

inflammatory response by reducing the prostaglandin, leukotriene and platelet activating factor synthesis that result from activation of phospholipase A2.

Metabolic and Antianabolic effects:

Glucocorticoids have antianabolic effects on lymphoid and connective tissue, muscle, fat and skin. Supraphysiological amount of glucocorticoids lead to decreased muscle mass, weakness and thinning of skin.

Due to anti-inflammatory effects, corticosteroid delays the beginning of healing process and decrease the intensity of healing. Immunosuppressive action increases the chances of infection there by further hindering healing process. Catabolic and antianabolic process keeps the patient in undernourished state. All the above described effects together hinder wound healing and predispose to burst abdomen.

Anabolic Steroids:

Testosterone in the immediate perioperative period was found to increase the tensile strength of incised wound and to accelerate contraction in excised wound in the animal models studied.

Estrogens and Progestogens:

These drugs have a variable effect on experimental wound healing, with a decrease in granuloma formation and angiogenesis, but no decrease in wound strength when administered in the perioperative period.

Radiation:

Changes occur in irradiated tissue that will have a detrimental effect on the healing of a surgical wound. Perhaps the most significant changes in irradiated skin or any tissue is the diminution in blood supply, the result of an alliterative endarteritis. This results in endothelial proliferation, subintimal fibrosis, and a gradual decrease in the vascular lumen. The remaining lumen may be occluded totally by thrombosis. This impairment in blood supply produces an ischemia that may have a crucial effect on wound healing.

Hypothyroidism:

Kowalewski and Yong have shown that biosynthesis, solubility and overall metabolism of collagen in hypothyroid rats are deficient.

Experimental work by Lennox and Johnston has shown that wound healing is accelerated by a mean of 2.5 d in a hyperthyroid group of rats and delayed by a mean of 2.0 d in the hypothyroid group as compared with control rats. Mehegan and Zamick demonstrated that T3 has a beneficial effect on the healing of deep dermal bums in rats. There is better organization of collagen bundles, fewer retraction spaces, and smoother scars. Another experimental study by Hemdon et al showed that epithelisation is inhibited at low and high doses of levothyroxine sodium. However, administration of levothyroxine sodium at the intermediate dose of 30 mg/kg results in improved wound closure relative to euthyroid control subjects. Histologically, collagen fibers within the

wound appear shorter and thinner, which probably account for decreased wound tensile strength.

Another study also demonstrated that the hormonal replacement therapy in hypothyroidism cases is beneficial with regard to wound healing and the results are more satisfactory if zinc is added to the therapy.

Natori et al analyzed the relationship between hypothyroidism and wound healing, by measuring the levels of hydroxyproline and procollagen peptide (types I and III), which are the precursors of collagen (type IV: 7S) in wounds. The results indicate a significant decrease in type IV collagen and hydroxyproline in the surgical hypothyroid rat group during the inflammatory phase and extending to the proliferative phase. These findings suggest that thyroid hormone is associated with the proliferation and secretion of fibroblasts in the process of wound healing.

PREVENTION

Preventing wound dehiscence is largely a function of careful attention to technical detail during the fascial closure. The technical details of fascial closure include such things on proper spacing of the sutures, adequate depth of bite of the fascia, relaxation of the patient during fascial closure and closing the fascial layer only when there isnot excessive tension on the closure. For very high risk patients an interrupted figure-of-eight closure is often the wisest choice while retention sutures were used extensively in the past, their use is less common today with many surgeons opting to use n absorbable mesh interrupted closure Reduction of massively distended bowel by milking air and fluid brake up into the stomach also may facilitate a tension free closure.

After technical aspect, it is the control of infection that can significantly reduce wound infection and hence wound dehiscence.

Euglycemia pre-operatively, per-operatively and during post-operative period is important. Poorly controlled or labile diabetic patients present more difficult management problems. Elective surgery has to be postponed till the diabetic status is known to be well under control. All patients on oral hypoglycemic and long acting insulin are shifted to plain insulin. The intra

operative measurement of blood glucose by the chemistrip BU finger skin method is quite convenient.

Experimental evidence substantiates the potential for diminished wound healing with most antineoplastic agents used in the perioperative period. It would seem reasonable to with hold antineoplastic drugs until wound healing is firmly established and the time for potential post operative complication has passed. As always, the risk of potential complications must be weighed against the benefits of preoperative antimetabolite therapy in each individual circumstance and good clinical judgment used to make a fine decision.

Radiation wound present a difficult problem for both patient and physician. Flap design and transfer aid the surgeon in successfully treating these difficult wound.

In patient who is malnourished pen-operative repletion should be accomplished by the route that exposes the patient to the least risk and is possible. Elective surgeries should be delayed until the patient is satisfactorily supplemented. The exact feeding regimen should the tailored to each individual patient. In patients who are not likely to take nutrition orally, TPN should be initiated early. Nutrition should be as specific as possible to the patient’s perceived nutritional deficiency and substrates that are turned over rapidly

should be included. 01 greatest importance is that nutritional deficiencies are recognized early and the repletion be initiated early because ever brief periods of malnutrition can have significant negative effects on wound healing.

PREVENTION OF INFECTIONS:

The operating surgeon plays a major role in reducing or minimizing the presence of postoperative - wound infections. Patients who are heavy smokers should be encouraged to stop smoking around the time of the operation. Obese patients should be encouraged to lose weight if the procedure is elective and there is time to allow significant weight loss. There is good evidence that tight control of glucose levels, especially in diabetics, will lower the risk of wound infections. Similarly, patients who are on high doses of corticosteroids will have lower infection rates if weaned off of corticosteroids or are, at least, on a lower dose. The night before surgery, patients should be encouraged to take a shower or bath in which an antibiotic soap is used. Similarly, for patients who are undergoing intra-abdominal surgery, a bowel preparation should be strongly considered. At the time of the operation, the surgeon should make certain that the patient undergoes a thorough skin preparation with appropriate antiseptic solutions such as iodine-based solutions and is draped in a very thorough and careful fashion. During every step of the operation, the surgeon can make certain that there is careful handling of the tissues. Meticulous homeostasis and

debridement of devitalized tissue will be helpful. Similarly, compulsive control of all intraluminal contents is imperative. Ensuring that the operated organs have adequate blood supply for healing also seems to be an important element of preventing wound infections. Eliminating a foreign body from the wound is another factor that the surgeon can control. There is strong clinical evidence that keeping the patient euthermic during the operation plays a major role in avoiding postoperative infections. The surgeon also must be careful to ascertain that there are no breaks in sterile techniques, such as holes in the glove or use of instruments that have been contaminated. When purulent drainage is found, thorough drainage of the wound with voluminous warm saline irrigation seems to be an important element in preventing postoperative wound infections.

For dirty or contaminated wounds, the use of antibiotics is a must during preoperative and postoperative period. There are some recent data that indicate a small but significant benefit may be achieved through prophylactic administration of a first-generation cephalosporin for certain types of clean and clean- contaminated procedures. The appropriate preoperative antibiotic is a function of the most likely inoculum based on the area being operated on. For example, for patients undergoing upper gastrointestinal tract surgery, complex biliary tract operations, or elective colonic resections, administration of a second-generation cephalosporin such as cefoxitin or a penicillin derivative

with a beta-lactamase inhibitor would be suitable. Surgeons would give a preoperative dose, appropriate intraoperative doses approximately 4 hours apart, and two postoperative doses appropriately spaced. There is convincing evidence that the timing of the prophylactic antibiotic administration is critical, To be most effective, the prophylactic antibiotic agent should be administered intravenously before the incision is made so that the tissue levels are present at the time the wound is created and exposed to the bacterial contamination. The use of drains remains somewhat controversial in preventing postoperative wound infections.

MATERIALS AND METHODS

The material for this study was obtained from the patients older than 18 years admitted to the surgical wards at Madurai Medical College, Madurai with abdominal wound dehiscence following midline laparotomy.

During this period 18 cases admitted in various surgical units were studied in detail as per the Proforma.

Methods:

Patients older than 18 years with abdominal wound dehiscence following midline laparotomy were studied making use of the available facilities in the Madurai Medical College & Hospital. Method of the study consists:

1. Detailed history and physical examination.
2. Relevant systemic examination.
3. Evaluation of the preoperative status.
4. Diagnosis and procedure done.

ROUTINE LABORATORY TEST:

Blood studies:

Hemoglobin and white cells counts taken on admission are highly informative. Only a rising or marked leucocytosis indicates inflammatory condition, Patients with hemoglobin levels below l0gm% are considered as anemic.

Serum electrolytes, sugar, urea and creatinine are important, especially if hypovolemia is expected. Uremia may present itself with persistent vomiting accompanied by increasing distention of the abdomen.

In patients with suspected hepato biliary disease, LFT (Serum bilirubin alkaline phosphatase SGOT, SGPT) albumin and globulin are useful to differentiate medical from surgical disorders, to gauge the severity of underlying disease and to assess the nutritional status.

Urine Test:

So easily performed, yet frequently over looked. Dark urine or raised specific gravity reflects mild dehydration in patient with normal renal function. Hyper bilirubinemia may give rise to tea colored urine and the froth on shaking.

Microscopic proteinuria confirms diabetic nephropathy.

Radiological studies:

Plain chest X-ray: A chest x-ray is essential in all cases of acute abdomen for preoperative assessment. COFD changes pulmonary infection has implications on post operative events like wound dehiscence.

Plain X-ray abdomen: Plain supine and erect films of the Abdomen or lateral decubitus view in weak patients should be obtained. Radiographic abnormalities are present up to 40% of patients with acute abdomen but are diagnostic only half the time. X-ray of abdomen is not mandatory in unstable

individuals in who clear cut physical signs mandating laparotomy already exist or patient with only mild resolving non-specific pain.

X-Ray findings in General Pathological conditions

1. **Air fluid levels** due to ileus are characterized by gas being seen throughout the GI tract.

Ileus may be seen in

- General or local peritonitis
- Typhoid fever
- Blunt injury abdomen
- Fracture spine
- Secondary gaseous distension after
    - Biliary colic
    - Ureteric coli
    - Torsion
    - Retroperitoneal hematoma

Bowel obstruction is manifested by multiple air and fluid level with dilation of the bowel proximal to the obstruction. A high small bowel obstruction may be difficult to diagnose because repeated vomiting will effectively decompress the obstructed segment. Small bowel obstruction is

differentiated from large bowel obstruction by identifying circular valvulae conniventes, folds of mucous membrane of small bowel and the haustral folds.

2. Pneumo peritoneum:

Free air in peritoneum is usually detected when X-ray is taken in erect posture. The film includes diaphragm. If the patient is too ill, he may be placed in lateral position, that is lying on one flank up and X-ray obtained as lateral view of abdomen.

Free air develops in association with perforated viscus, commonest being perforated duodenal ulcer. Here gas collects in moderate quantities usually under the right hemi diaphragm. In contrast, in small intestine perforation only a small quantities of air escape. In perforation of the stomach and colon may be associated with much larger quantities of free intra peritoneal air which commonly accumulated under the diaphragm.

Other conditions with free air under diaphragm being typhoid perforation, diverticulitis with perforation. Pneumo peritoneum is unusual in appendicular perforation. Free gas under hemidiaphragm is present in approximately 80% of perforated ulcers and carbonates the clinical diagnosis.

RESULTS AND ANALYSIS

18 patients with wound dehiscence following mass closure of midline laparatomy were studied. Their preoperative status was studied. Incidence of various etiological factors in abdominal wound dehiscence were as follows.

Age and incidence

- Mean age of the study subject was 35.8 and the range was 18-90 years.
- 77.5% were male patients; 22.5% were female patients. Male female ratio was 3.5:1.

Table 1: Incidence of various abdominal condition

Incidence of various abdominal conditions in patient with wound dehiscence was as follows

	No. of cases	**Percentage**
Duodenal ulcer perforation	13	72.2
Ileal perforation	4	22.3
Appendicular perforation	1	5.5

History

Table 2: Duration of symptom (from on the onset of symptoms to the time of surgery)

Days	No of patients
1	2
2	3
3	5
4 and above	8

Duration of symptom in cases varied from 1 to 9. Following table shows the duration of symptoms before patients underwent surgery. More than 40% of dehiscence were in the patients with symptoms of longer duration (>4 days). Longer duration of symptoms was associated with more sever contamination and hemodynamic instability.

Table 3: Co morbid condition at the time of admission

Conditions	No of cases	Percentage
Diabetes	3	16.5
Hypertension	-	-
Pulmonary disease	3	16.5
Malnutrition	10	55

Anemia	7	38.5
Drug history	-	-
CRF	-	-
Malignancy	-	-
Intra abdominal infection	18	100
Radiation	-	-

Table 4: General Physical Examination

	No of patients	**Percentage**
Pallor	9	50
Jaundice	4	22
Pedal edema	4	22
BP (systolic <100- stock)	5	27.5

Pulse rate

- 7 (39.5%) patients had normal pulse rate and normal rhythm
- 11 (62.5%) patients had tachycardia (PR>100)

Blood pressure

- No patients were hypertensive
- 6 (33%) patients were in shock at the time of admission
- 12 (77%) patients were with in normal range

Table 5: Anemia

HB	No of patients	Percentage
≤8	5	27.5
8-10	2	11
>10	11	60.5

Table 6: Chest X-ray Findings

X- Ray Findings	No of patients	Percentage
Gas under diaphragm	17	94.5
Chronic obstructive pulmonary disease	3	16.5
Pulmonary Koch	-	-

On X-ray 17 showed gas under diaphragm, 3 chronic obstructive pulmonary disease, no pulmonary kochs.

Table 7: Electrocardiogram

Electrocardiogram	No. of patients
Normal	17
Abnormal	1

Out of 18 patients abnormal findings were present in 1 and rest were normal.

Table 8: Renal function test (RFT)

RFT	No of patients	
	Normal	Raised
Blood urea	14	4
Serum Creatinine	15	3

Renal function was assessed by measuring blood urea and serum Creatinine. Of the 18 patients 4 had raised blood urea levels (>40mg/dl) and 3 had raised Creatinine levels (.1.5mg/dl).

Table 9: Liver function test (LFT)

LFT	No of patients	Percentage
Hypoprotinemia (albumin <29gm/dl)	5	27.5
Hyperbilirubinemia (total bilirubin >1.5mg/dl)	4	22
Raised liver enzyme	4	22

8 (44.5) of patients showed abnormal liver function tests in which there was 5 (27.5) hypoprotinemia 4 (22%) hyperbilirubinemia and 4 (22) raised liver enzyme.

Table 10: Serum electrolyte

Serum electrolytes	No of patients with abnormal values	Percentage
Serum electrolytes	4	22
Hypokelemia	3	16.5
Hyponetremia	1	5.5

4 (22%) patients had abnormal serum electrolytes. Three of the patients had hypokelemia and one had hyponatremia. Hypokelemia being one of the common cause for postoperative paralytic ileus and abdominal distension.

Table 11: Procedure performed

Diagnosis	Procedure
Duodenal ulcer perforation	Grahams omental patch closure
Ileal perforation	Wedge resection and closure
Appendicular perforation	Appendicectomy

All the duodenal perforations were due to acid peptic disease. Widal test was positive in two patients with ileal perforation and no cause was identified in another patient.

Table 12: Predisposing factor developing during post operative period

Factor	No of patients	Percentage
Vomiting	5	33
Chest infection	7	38.5
Abdomen distension	9	50

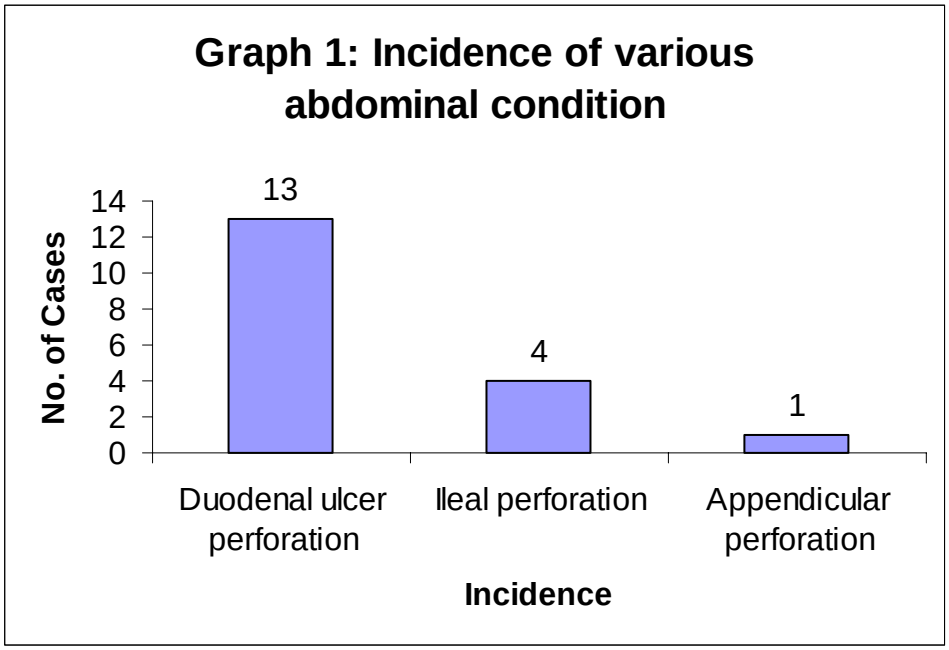
Table 13: Mortality and survivals

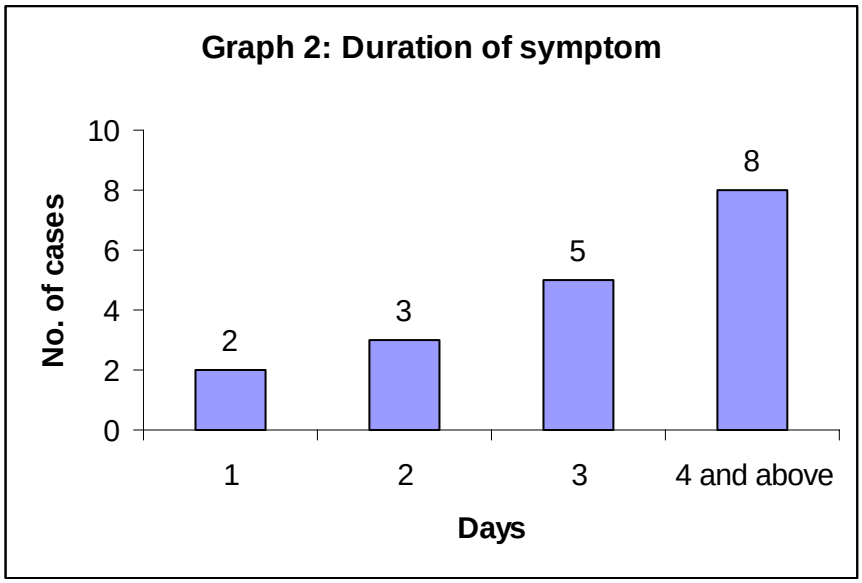
Total No. of patients	No. of patients	Percentage
18	17	1

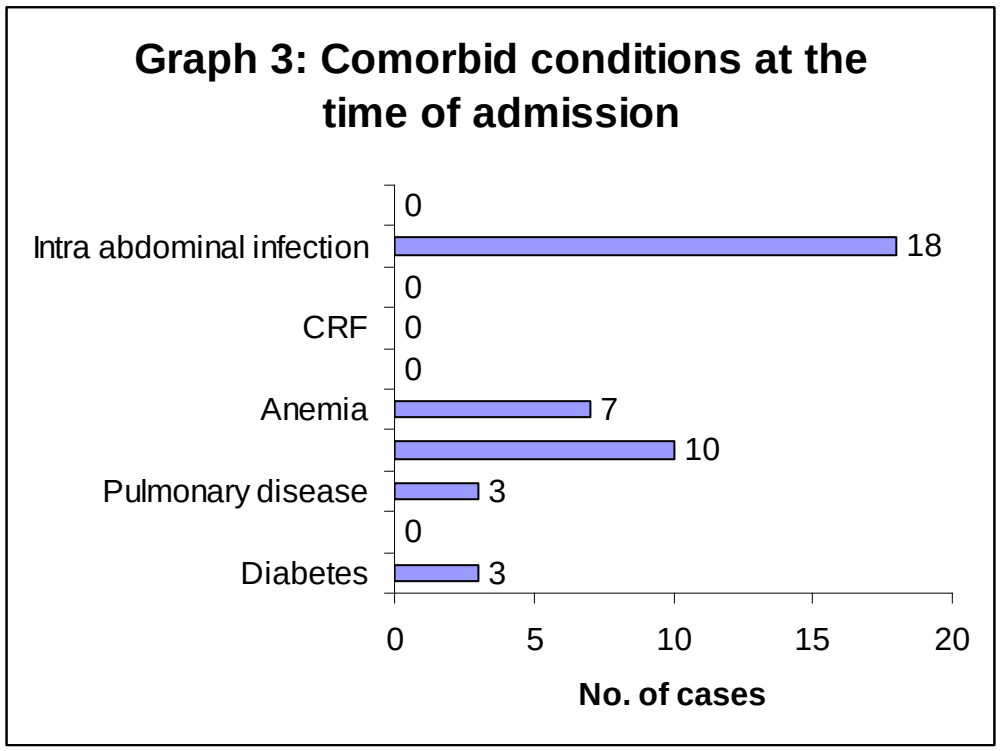
Table 14: Duration of Hospital Stay

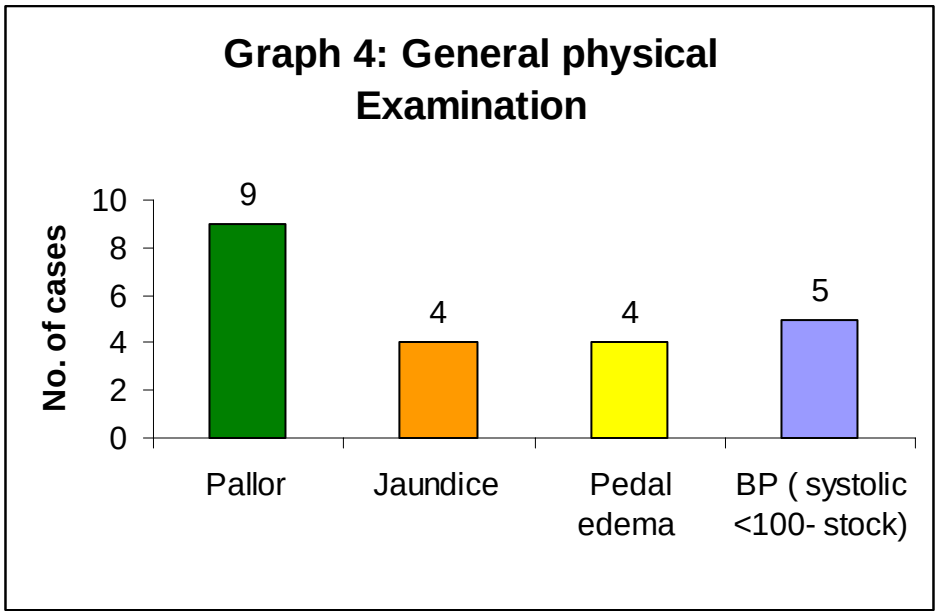
Average Stay	25.2
Range of stay	9-47

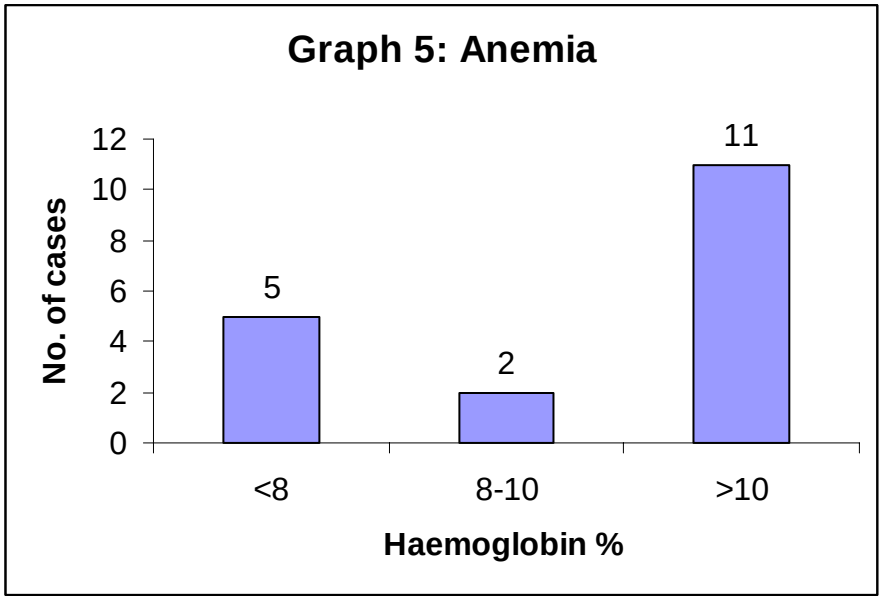
In the postoperative period few patients did had vomiting, chest infection and distension which did contributed to wound dehiscence. There was one mortality, significant rise in the morbidity was noted and average hospital stay was 25.2 days. Mortality was due to septicemia.

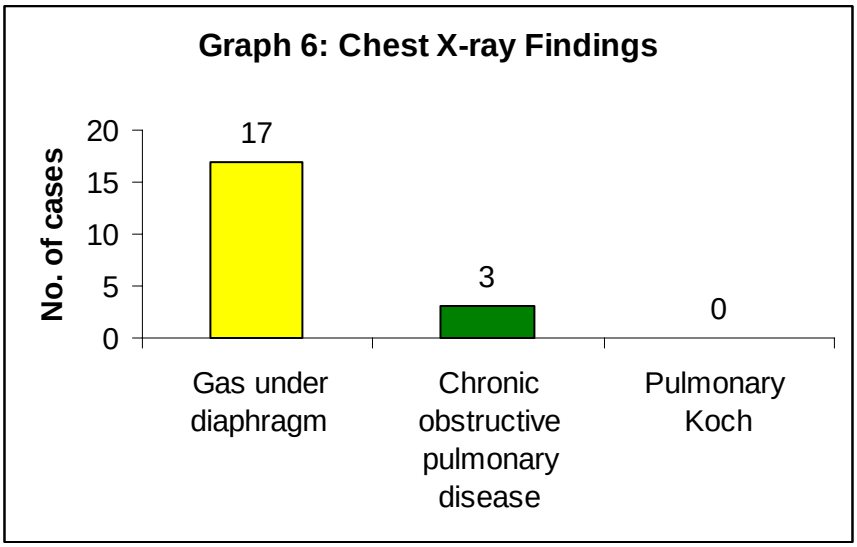


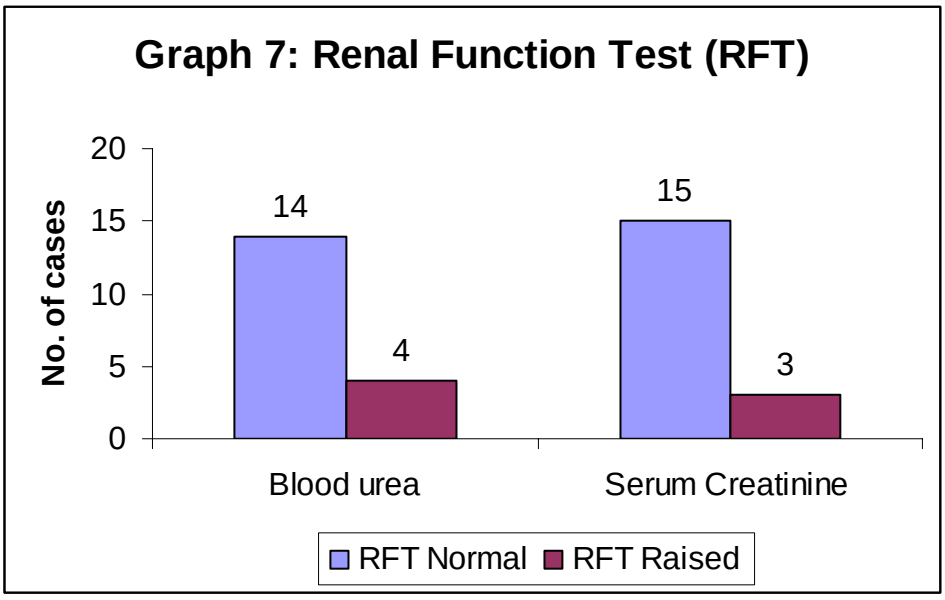

Graph 2: Duration of symptom
No. of cases
10
8
6
4
2
0
2
3
5
8
1
2
3
4 and above
Days

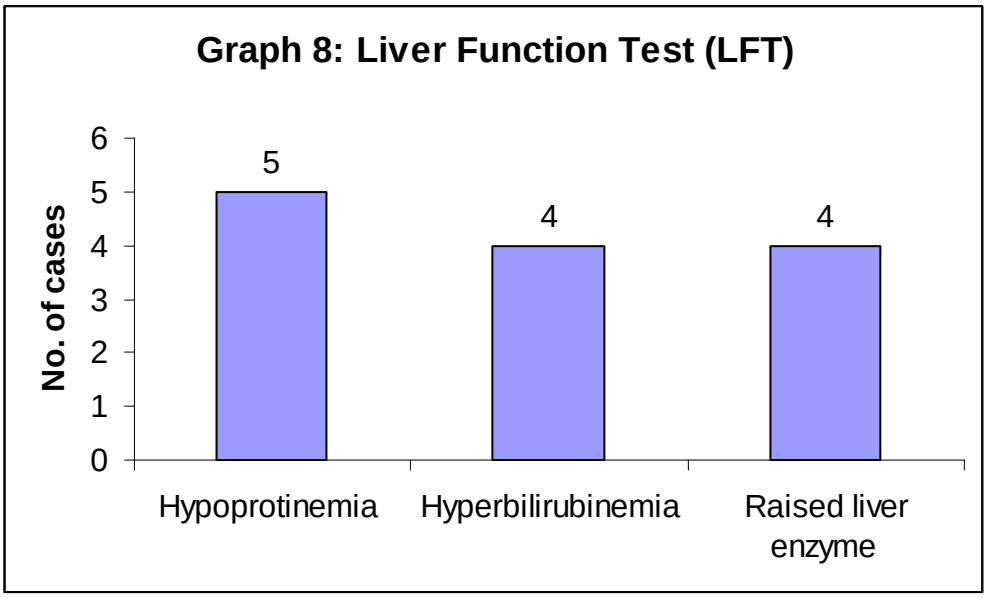

Graph 3: Comorbid conditions at the time of admission
Intra abdominal infection
CRF
Anemia
Pulmonary disease
Diabetes
0
18
0
0
0
7
10
3
0
3
0
5
10
15
20
No. of cases

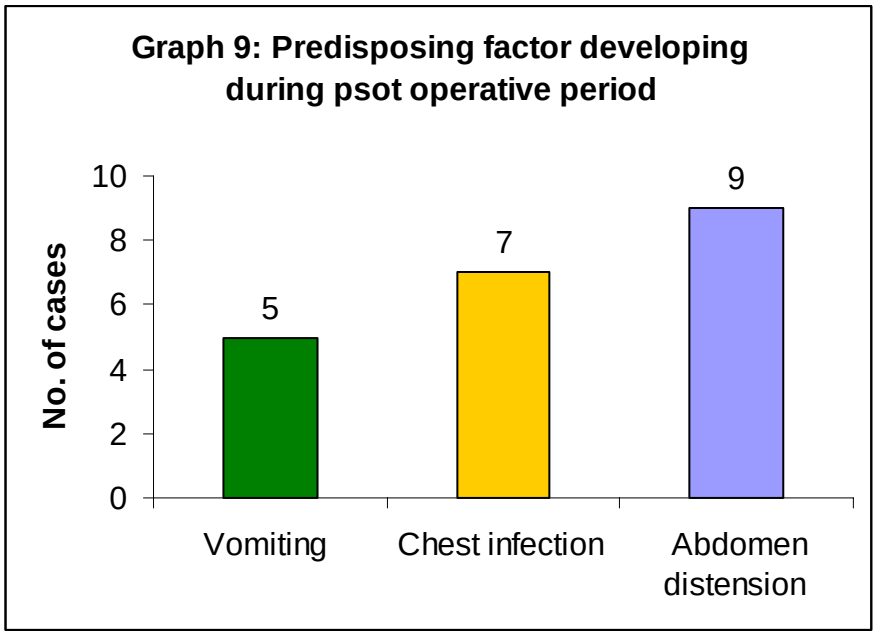

Graph 4: General physical Examination
No. of cases
10
8
6
4
2
0
9
4
4
5
Pallor
Jaundice
Pedal edema
BP (systolic <100- stock)

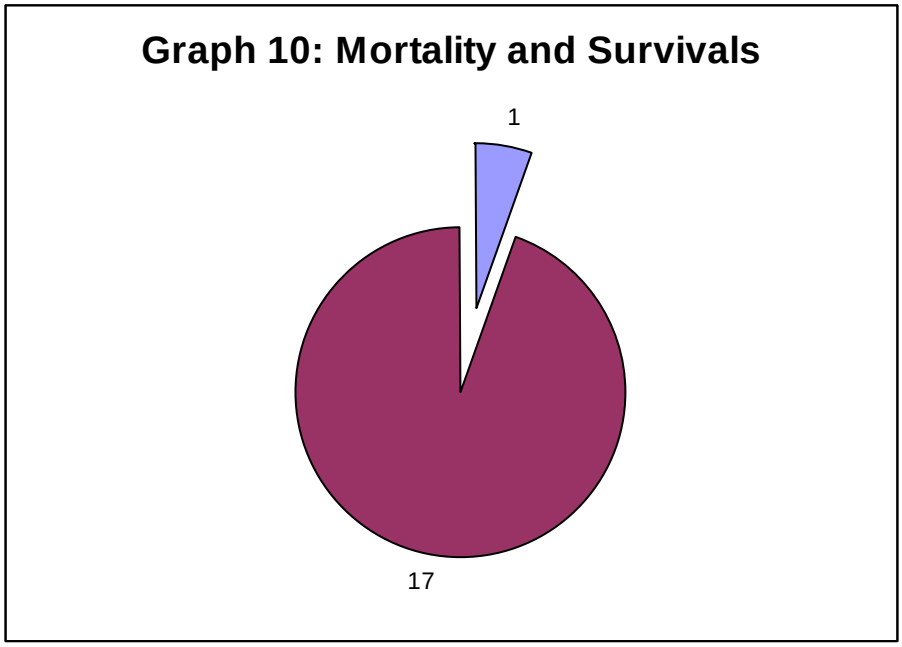

Graph 5: Anemia
No. of cases
12
10
8
6
4
2
0
5
2
11
<8
8-10
>10
Haemoglobin %


Graph 6: Chest X-ray Findings
No. of cases
20
15
10
5
0
17
3
0
Gas under diaphragm
Chronic obstructive pulmonary disease
Pulmonary Koch


Graph 7: Renal Function Test (RFT)
No. of cases
20
15
10
5
0
14
4
15
3
Blood urea
Serum Creatinine
RFT Normal
RFT Raised


Graph 8: Liver Function Test (LFT)
No. of cases
6
5
4
3
2
1
0
5
4
4
Hypoprotinemia
Hyperbilirubinemia
Raised liver enzyme


Graph 9: Predisposing factor developing during psot operative period
No. of cases
10
8
6
4
2
0
5
7
9
Vomiting
Chest infection
Abdomen distension


Graph 10: Mortality and Survivals
1
17

DISCUSSION

Table 15: Comparison of sex distribution

	Anurag et al	Jean Pierre	Present study
Male	5 (55.6%)	22 (70%)	14 (77.5%)
Female	4 (43.4%)	9 (30%)	4 (22.5%)

Burse abdomen seen marginally more frequently in males in Anurag et al's study, so also in our study. In Khan's study at Queen Hospital 2.8:1 was the male to female ration. In Jean Pierre et al study male predominance was seen but it was not statically significant. Though burse was consistently seen more frequently in males in most of the studies no exact cause could be elucidated.

Table 16: Comparison of group Age Group

Age	Anurag et al	Present study	Gurlenvik
Mean	34.4 yr	35.8 yr	58 yr
Range	26-61	18-90	-

Mean age of present study was comparable with Anurag study. Present study group was relatively younger than Gurlenvik study group. Both Anurag et al study and Gurlevik study concluded advanced age because of attended Co-morbidity increases the chances of wound dehiscence. Range was wider in the present study than in Anurag's study. In a study by Pavlidis TE et al published

in European journal of surgery 2001, it was concluded that age >65 was significant factor for wound dehiscence.

Table 17: Comparison of incidence of Anemia

Anemia	Anurag et al	Jean Pierre	Present study
Hb <10gm%	6 (66%)	28 (90%)	7 (39.5)

Anemia is defined as hemoglobin less than 10gm percentage. In Anurag study anemia was seen in 66% of patients. In present study it was seen in 39.5% of patients.

Relative risk of burst was 1.82% in patient with anemia in Anurag's study. In jean-pierre et al study though anemia was seen in more than 90% of the patients it was not statistically significant. Even Pavlidis et al in their study "complete dehiscence of the abdominal wound and incriminating factors" found that anemia was not a predisposing factor in contradiction to Anurags study.

Table 18: Comparison of Liver Function Test

Hypoprotinemia defined as serum albumin levels less than 3gm/dl. Hyperbulirubinemia is defined as total Bilirubin greater than 1.5mg/dl.

LFT	Present study	Alexander et al	Hydra et al
Hypoprotinemia	27.5 (%)	53	-
Hyperbilirubinemia	22.0 (4)	1	16

In a study by Alexander et al 53% of patients with burst had hypoalbuminemia. In our study it was 27.5%. Alexander's study also reveled that only 9% of patient in whom no burst was seen had hypoprotinemia. Clearly hypoprotinemia increased the risk of wound dehiscence. In a study by Daley BJ et al they observed that 50% of patients admitted in surgical wards are malnourished.

In our setting malnourishment will be even more common and more sever. In study by Hydarpash hyperbilirubinemia was seen in 16%; in our study it was 22%. They concluded hyperbilirubinemia is a risk factor for burst.

Intra abdominal infection

Peritonitis contributed for 45.3% of bursts in Anurag's study. In our study all the patients with bursts presented with peritonitis. Fecal peritonitis was seen in ileal perforation. Purulent peritonitis was seen in duodenal perforation. Culture yielded polymicrobial growth which were sensitive to cephlosporins and aminoglycosides.

Table 19: Comparison of incidence of Chest infection

	Anurag et al	**Makela**	**Present study**
Chest Infection	35.5 (3)	32% (16)	16.5 (3)

Chest infection was more frequently seen in patient with wound dehiscence. In Anurag et al study chest infection was seen in 35.5% 93)

patients. In the study it was concluded that chest infection is a significant factor in predisposing to wound dehiscence. In present study 16.5% patient with burst did had chest infection. In Makelas study chest infection was more frequently associated with patients with wound dehiscence than patients with out dehiscence and it was statistically significant.

Diabetes

In a study by Cruse et al; incidence of wound infection doubled to 10.4 to 10.71 in diabetic compared to non diabetics (4.8 to 7.4%). In present study one patient i.e., 5.5% was diabetic.

In a study by Polk et al; controlled for age the incidence of wound dehiscence in diabetic surgical patient was the same as in non diabetics. In Goodson's study he concluded that only poorly controlled diabetics have impaired healing.

Abdominal distension

Abdominal distension was present in all cases of dehiscence in Anurag's study where as it was present only in 50% of cases in present study.

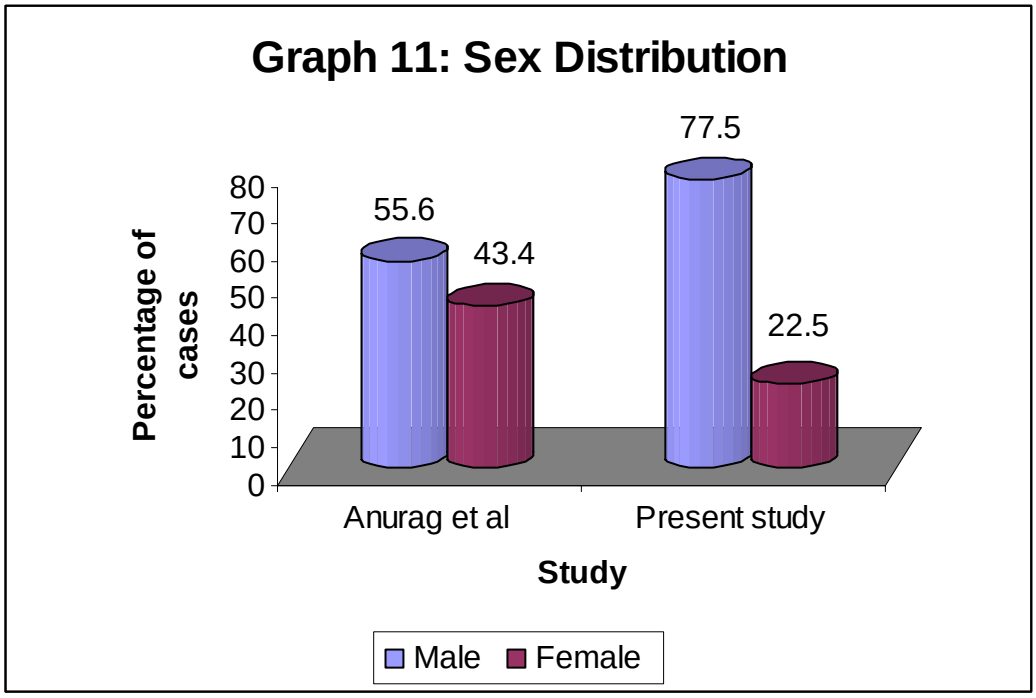
Emergency surgeries

In Anurag et al study 9% of emergency case had burst. All the burst in present study underwent emergency procedure.

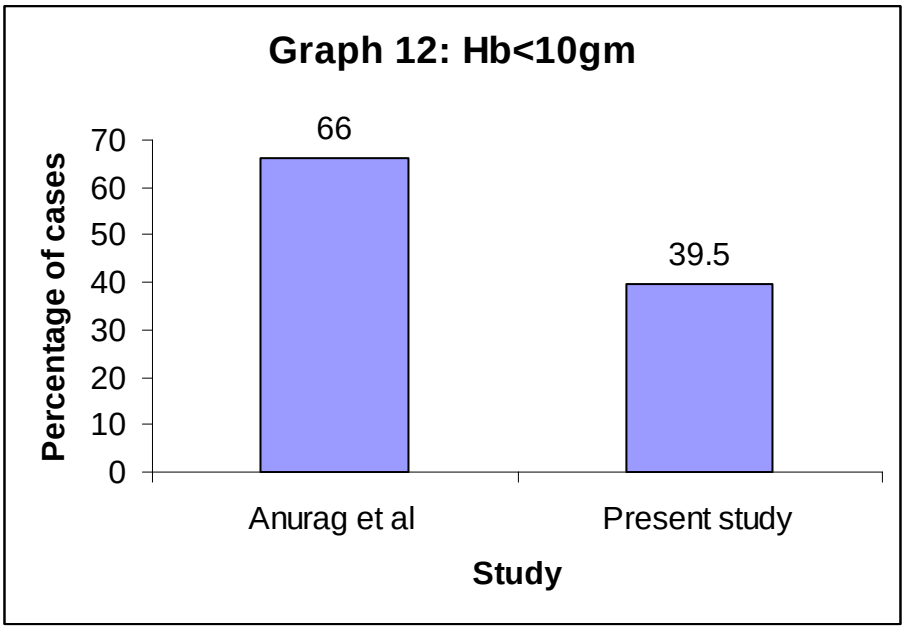
Hospital stay

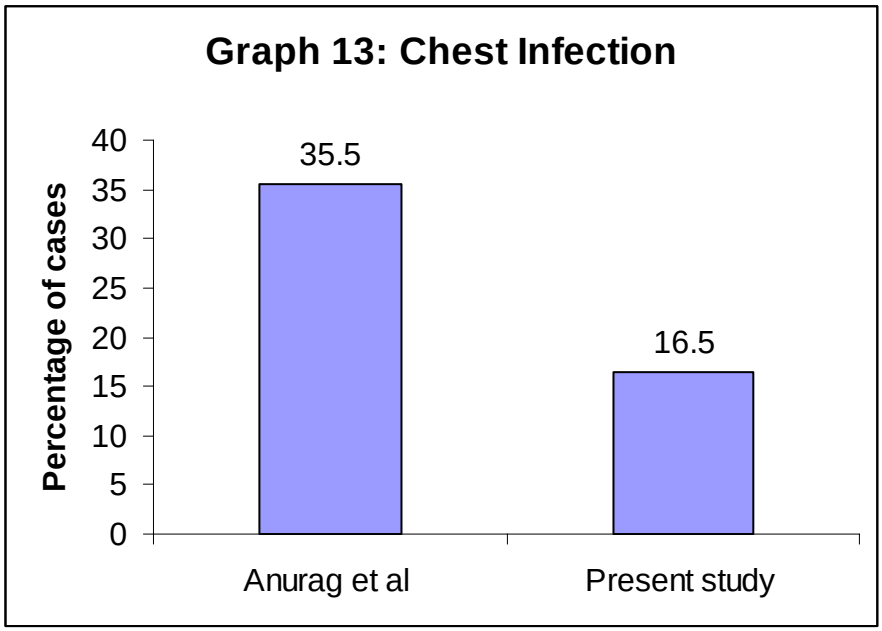
In a study by Servio de Cirugia conducted at University Hospital at Girona, Spain the mean length of hospital stay was 28.5 days. In our study it was 25.2 days.

Mortality



18% was the mortality in Anurag's study and in our study there was one death amounting to 5.5% mortality. Cause of death in our study was septicemia.


Graph 12: Hb<10gm
Percentage of cases
70
60
50
40
30
20
10
0
66
39.5
Anurag et al
Present study
Study


Graph 13: Chest Infection
Percentage of cases
40
35
30
25
20
15
10
5
0
35.5
16.5
Anurag et al
Present study

CONCLUSION

- Abdominal wound dehiscence causes significant morbidity and mortality.
- Intraperitoneal infection is the most important factor in predicting burst.
- Delay in therapeutic intervention increase incidence.
- Malnutrition and anemia contribute significantly to burst abdomen.
- Emergency procedure is prone for burst abdomen.
- Simple investigations like Hb%, RFT, LFT RB5 may help to detect predisposing factors.
- Hospital stay and health expenditure is usually protracted

SUMMARY

- 18 patients aged between 18 years and 90 years had their abdomen burst following midline laparotomy.
- All the case were perforative peritonitis, duodenal ulcer perforation being the most common etiology (14 cases 72. %)
- History, clinical examination and investigations revealed various predisposing factor.
- Clinical examination identified pallor in 9 patients, Jaundice in 4 patients and shock in 5 patients.
- On laboratory investigations anemia was present in 33.5%; hypoprotinemia in 27.5% and hyperbilirubinemia in 22%, renal functions were abnormal in 4 patients.
- All the procedures were done in emergency settings of which Graham's omental patch repair of duodenal perforation followed by closure of ileal perforation were common.

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ANNEXURE

PROFORMA

1. Name:	4. Occupation:	6. DOA:
2. Age:	5. Address:	7. DOS:
3. Sex:		8. DOD:
		9. IP No:

CHIEF COMPLAINTS:

PAST HISTORY:

HT / DM / KOCHS / Previous surgery / Renal problem / Chest disease

Drug history: Steroids / allergic to medication

FAMILY HISTORY

Examination:

Pallor: Cyanosis:

Pedal edema:

VITAL SIGNS:

PR: BP: RR:

Temp:

SYSTEMIC EXAMINATION:

CVS: RS:

CNS:

INVESTIGATION:

Hb:

TC:

DC:

Chest X-ray:

CVS: ECG:

Renal function test: Blood urea: Serum creatinine:

Endocrine: FBS: PBS: RBS:

LFT: Total protein

Serum Albumin

Serum Globulin

Total Biluribin

Direct Bilurbin

URINE EXAMINATION:

Albumin: Sugar: Microscopy:

Pre operative preparation:

- Nil orally precious night / time of admission
- Parts prepared from nipple to knee
- Consent for surgery
- Antibiotics

MASTER CHART

Sl. No.	IP. No.	Age (yrs)	Sex	Name	DOA	DOD	Jaundice	Anaemia	Pedal Oedema	Dehydration	PR	BP	HB	TC	RFT		LFT		RBS	SE	Emergency	CD
															BU	SR	HP	HB				
1	36327	50	M	Seenithevar	9.07.07	3.08.07	-	+	-	+	98	112/80	12	8000	57	0.9	-	-	108	N	+	DUP
2	33578	39	M	Pandian	9.6.07	1.7.07	-	+	-	+	120	70/0	9	7300	17	0.6	-	-	142	N	+	DUP
3	37263	28	M	Sakthivel	9.7.07	8.8.07	+	+	+	+	110	80/0	10	5600	30	0.9	-	-	81	N	+	DUP
4	37180	35	M	Rasiah	18.7.07	1.9.07	-	+	-	-	100	32/70	9	6300	18	0.8	+	+	88	N	+	DUP
5	35465	32	M	Gopal	29.6.07	12.7.07	-	-	-	-	90	126/80	12	6400	17	0.6	-	-	58	Ab	+	DUP
6	30618	45	M	Vellaiyan	7.5.07	21.5.07	-	+	-	-	110	120/80	6.2	7300	21	0.8	-	-	160	N	+	DUP
7	35394	30	F	Mallar	9.3.07	26.3.07	-	-	-	-	80	122/70	13	7200	31	0.9	-	-	63	N	+	DUP
8	34621	45	F	Kalyani	20.6.07	7.7.07	-	+	-	-	70	130/80	10	5200	21	0.6	+	-	90	N	+	DUP
9	38291	24	F	Renuka	31.7.07	12.9.07	-	-	-	-	104	122/70	11	6300	62	2	+	-	70	N	+	DUP
10	38897	21	F	Girija	8.08.07	22.8.07	-	+	-	-	112	130/80	6.2	11000	21	1.1	+	-	102	Ab	+	DUP
11	38019	90	M	Mookiah	23.07.07	18.8.07	-	-	+	+	110	70/30	14	7000	126	2.1	-	+	112	Ab	+	DUP
12	36212	40	M	Sivakumar	21.9.07	18.10.07	-	-	+	-	92	130/70	12	6300	30	0.9	+	-	150	N	+	DUP
13	32612	40	F	Podhumponnu	21.9.07	6.10.07	-	+	-	-	100	70/50	12.9	7100	32	0.6	-	-	119	N	+	DUP
14	39415	45	M	Kuppusamy	4.11.07	19.11.07	-	-	-	-	132	122/70	10.1	8300	21	0.7	-	-	92	N	+	DUP
15	37632	18	M	Nagaraj	29.11.06	6.1.07	-	-	-	-	112	122/80	11	6300	28	2	-	-	90	N	+	DUP
16	33215	32	M	Karuppan	20.12.07	14.1.07	+	+	-	+	112	70/50	7	6300	22	0.8	-	+	100	N	+	DUP
17	34808	18	M	Ramar	8.11.06	17.01.06	+	-	+	+	90	130/40	7	11000	12	3.1	-	+	70	Ab	+	DUP
18	35521	22	M	Murugan	9.8.07	22.08.07	-	+	-	-	80	80/50	8	9210	31	0.2	-	+	84	N	+	DUP